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→ Solubilidade e Equilíbrio

① a- $MgC_2O_4 \xrightarrow{H_2O} Mg^{+2} + C_2O_4^{-2}$

$8{,}5\times10^{-5}$ $\quad s \quad s$

$K_{ps} = 8{,}5\times10^{-5}$

$8{,}5\times10^{-5} = s^2$

$\boxed{s = 9{,}23\times10^{-3}}$

b- $Na_2C_2O_4 \longrightarrow 2Na^{+} + C_2O_4^{-2}$

$0{,}020 \quad 0 \quad s$

$- \quad 2s \quad s+0{,}020$

→ íon comum

$8{,}5\times10^{-5} = [C_2O_4^{-2}][Mg]$

$8{,}5\times10^{-5} = [0{,}020+s].[s]$

$s^2 + 0{,}020s - 8{,}5\times10^{-5} = 0$

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$\boxed{x = 3{,}6\times10^{-3}}$

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② a- $SrSO_4 \xrightarrow{H_2O} Sr^{+2} + SO_4^{-2}$

$s \quad s$

$2{,}5\times10^{-7} = [Sr^{+2}].[SO_4^{-2}]$

$2{,}5\times10^{-7} = s^2$

$\boxed{s = 5{,}0\times10^{-4}}$

b- $Na_2SO_4 \longrightarrow 2Na^{+} + SO_4^{-2}$

$0 \quad 0{,}015$

$- \quad 2s \quad s$

$- \quad 2s \quad 0{,}015+s$

$-$

$2{,}5\times10^{-7} = [0{,}015+s].[s]$

$2{,}5\times10^{-7} = 0{,}015s + s^2$

$s^2 + 0{,}015s - 2{,}5\times10^{-7} = 0$

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$\boxed{x = 1{,}66\times10^{-5}}$

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③ $1CaC_2O_4 \longrightarrow 1Ca^{+2} + 1C_2O_4^{-2}$

$4{,}76\times10^{-5} \quad 0 \quad 0$

$- \quad x \quad x$

$K_{ps} = [4{,}76\times10^{-5}][4{,}76\times10^{-5}]$

$\boxed{K_{ps} = 2{,}3\times10^{-9}}$

0,0061g — $4{,}76\times10^{-5}$ mol

128g — 1 mol

④

$$\begin{array}{lcc} PbI_2 \longrightarrow & Pb^{+2} & + \; 2I^- \\ 1{,}2 \times 10^{-3} & 0 & 0 \\ - & 1{,}2 \times 10^{-3} & 2{,}4 \times 10^{-3} \end{array}$$

$$K_{ps} = [1{,}2 \times 10^{-3}] \cdot [2{,}4 \times 10^{-3}]^2$$

$$\boxed{K_{ps} = 6{,}9 \times 10^{-9}}$$

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⑤

$$\begin{array}{lcc} CaF_2 \longrightarrow & Ca^{+2} & + \; 2F^- \\ 3{,}4 \times 10^{-11} & 0 & 0 \\ & x & 2x \end{array}$$

$$3{,}4 \times 10^{-11} = [x]\,[2x]^2$$

$$3{,}4 \times 10^{-11} = 4x^3$$

$$\boxed{x = 2{,}04 \times 10^{-4}} \rightarrow \mathcal{M} = \frac{m}{M \cdot V}$$

$$2{,}04 \times 10^{-4} = \frac{m}{78 \cdot 1\ell}$$

$$\boxed{C = 1{,}6 \times 10^{-2}\ g/L} \;\therefore\; m = 0{,}016\,g \longleftarrow$$

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⑥

$$\begin{array}{lcc} Ca_3(PO_4)_2 \xrightarrow{H_2O} & 3Ca^{+2} & + \; 2PO_4^{-3} \\ - & 0 & 0 \\ & 3\omega & 2\omega \end{array}$$

$$2 \times 10^{-33} = [3\omega]^3 \cdot [2\omega]^2$$

$$2 \times 10^{-33} = 27\omega^3 \cdot 4\omega^2$$

$$2 \times 10^{-33} = 108\,\omega^5$$

$$\boxed{\omega = 1{,}13 \times 10^{-7}} \quad \mathcal{M} = \frac{n}{V}$$

$$\boxed{3{,}50 \times 10^{-5}\ g/L} \;\therefore\; 1{,}13 \times 10^{-7} = \frac{m}{310 \cdot 1\ell}$$

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⑦

$$\begin{array}{lcc} Ca_3(PO_4)_2 \longrightarrow & 3Ca^{+2} & + \; 2PO_4^{-3} \\ 2 \times 10^{-33} & 0 & 0{,}10 \\ & 3x & 2x + 0{,}10 \end{array}$$

$$2 \times 10^{-33} = [3x]^3 \cdot [0{,}10]^2$$

$$2 \times 10^{-33} = 0{,}27\,x^3$$

$$x^3 = 7{,}407 \times 10^{-33}$$

$$\boxed{x = 1{,}95 \times 10^{-11}}$$

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⑧

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→ Equilíbrios Ácidos e Bases

①
$HAc \longrightarrow H^+ + Ac^-$

I. $0{,}100 \quad 0 \quad 0$

R. $0{,}100 - x \quad 1{,}32 \times 10^{-3}$

E. $0{,}098 \quad 1{,}32 \times 10^{-3}$

$$K_a = \frac{[1{,}32 \times 10^{-3}] \cdot [1{,}32 \times 10^{-3}]}{0{,}098}$$

$\boxed{K_a = 1{,}77 \times 10^{-5}} \longrightarrow pK_a = -\log K_a$

$\boxed{pK_a = 4{,}75}$

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②
$NH_3 + H_2O \longrightarrow NH_4^+ + OH^-$

I. $0{,}010 \quad 0 \quad 0$

R. $9{,}58 \times 10^{-3} \quad 4{,}2 \times 10^{-4}$

$$K_b = \frac{[4{,}2 \times 10^{-4}] \cdot [4{,}2 \times 10^{-4}]}{9{,}58 \times 10^{-3}}$$

$\boxed{K_b = 1{,}84 \times 10^{-5}}$

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③
$CH_3CO_2H + H_2O \longrightarrow H_3O^+ + CH_3CO_2^-$

I. $0{,}50$ mol/L $\quad 0 \quad 0$

E. $0{,}50 - x \quad x \quad x$

$$1{,}8 \times 10^{-5} = \frac{x^2}{0{,}50 - x}$$

$$x^2 + 1{,}8 \times 10^{-5} x - 9 \times 10^{-6} = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$\boxed{x = 3{,}00 \times 10^{-3}}$ ∴

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④
- $HCl \longrightarrow H^+ + Cl^-$

  $- \quad 0{,}100 \quad 0{,}100$

- $CH_3CO_2H + H_2O \longrightarrow H_3O^+ - CH_3CO_2^-$

  $0{,}100 - x \quad x \quad x$

$$1{,}8 \times 10^{-5} = \frac{x^2}{0{,}100 - x}$$

$$x^2 + 1{,}8 \times 10^{-5} x - 1{,}8 \times 10^{-6} = 0$$

$x = \dfrac{-b \pm \sqrt{\Delta}}{2a}$ ∴ $\boxed{x = 1{,}3 \times 10^{-3}}$

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⑤
$NaOH \longrightarrow Na^+ + OH^-$

$0{,}035 \quad 0 \quad 0$

$0 \quad 0{,}035 \quad 0{,}035$

$pOH = -\log [OH^-]$

$pOH = -\log [0{,}035]$

$pOH = 1{,}45$

$pOH + pH = 14$ ∴ $\boxed{pH = 12{,}5}$

$\boxed{M = \dfrac{0{,}700}{40 \cdot 0{,}5} \rightarrow M = 0{,}035 \text{ mol/L}}$

⑥ $4,32 = -\log [H^+]$

$[H^+] = 10^{-4,32}$

$[H^+] = 4,79 \text{ mol/L}$

$3,30 = -\log [OH^-]$

$10^{-3,30} = [OH^-]$

$[OH^-] = 5,0 \times 10^{-4} \text{ mol/L}$

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⑦

$H_{sáct}$	$\longrightarrow$	H^+	$+$	$Sáct^-$
0,100		0		0
0,0963		$3,715 \times 10^{-3}$		"

$$K_a = \frac{[3,715 \times 10^{-3}]\,[3,715 \times 10^{-3}]}{0,0963}$$

$$\boxed{K_a = 1,43 \times 10^{-4}}$$

dado: pH $= 2,43 \rightarrow [H^+] = 3,715 \times 10^{-3}$

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⑧

$C_6H_5CO_2H$	$\longrightarrow$	H_3O^+	$+$	$C_6H_5CO_2^-$
0,020		0		0
$0,020 - x$		x		x

$$6,3 \times 10^{-5} = \frac{x^2}{0,020 - x}$$

$$x^2 + 6,3 \times 10^{-5} x - 1,26 \times 10^{-6} = 0$$

$$x = \frac{-b \pm \sqrt{\Delta}}{2a} \quad \therefore \quad \boxed{x = 1,1 \times 10^{-3}}$$

$pH = -\log [1,1 \times 10^{-3}] \rightarrow \boxed{pH = 2,96}$

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⑨

$CH_3CH_2CO_2H$	$\longrightarrow$	H_3O^+	$+$	$CH_3CH_2CO_2^-$
0,100 mol/L		0		0
0,0988 mol/L		$1,15 \times 10^{-3}$		$1,15 \times 10^{-3}$

$$K_a = \frac{(1,15 \times 10^{-3})^2}{0,0988}$$

$$\boxed{K_a = 1,34 \times 10^{-5}}$$

dado: pH $= 2,94 \rightarrow [H_3O^+] = 1,15 \times 10^{-3}$ mol/L

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⑩

	$HOCN$	$\longrightarrow$	H_3O^+	$+$	OCN^-
I.	0,15		0		0
R.	$0,15 - x$		x		x

$$3,5 \times 10^{-4} = \frac{x^2}{0,15 - x}$$

$$x^2 + 3,5 \times 10^{-4} x - 5,25 \times 10^{-5} = 0$$

$$x = \frac{-b \pm \sqrt{\Delta}}{2a} \quad \therefore \quad \boxed{x = 7,1 \times 10^{-3}}$$

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⑪

HCO_2H	$\longrightarrow$	H_3O^+	$+$	HCO_2^-
0,0010		0		0
$0,0010 - x$		x		x

$$1,8 \times 10^{-4} = \frac{x^2}{0,0010 - x}$$

$$x^2 + 1,8 \times 10^{-4} x - 1,8 \times 10^{-7} = 0$$

$$x = \frac{-b \pm \sqrt{\Delta}}{2a} \quad \therefore \quad \boxed{x = 3,44 \times 10^{-4}}$$

% ionização

100 % — 0,0010 mol/L

% — $3,44 \times 10^{-4}$ mol/L $\rightarrow \boxed{34\%}$

pH $= 3,5$

⑫ $NH_3 \xrightarrow{H_2O} OH^- + NH_4^+$

I. 0,025   0   0

R. 0,025 - x   x   x

$1,8 \times 10^{-5} = \frac{x^2}{0,025 - x}$

$x^2 + 1,8 \times 10^{-5}x - 4,5 \times 10^{-5} = 0$

$\boxed{x = 6,62 \times 10^{-4}\ mol/L}$

→ $pOH = [6,62 \times 10^{-4}] \rightarrow pOH = 3,2 \therefore \boxed{pH = 10,8}$

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⑬ $KOH \rightarrow K^+ + OH^-$

$4,57 \times 10^{-4}$ 0   0

- $4,57 \times 10^{-4}$ $4,57 \times 10^{-4}$

pH = 10,66

pH + pOH = 14 → 10,66 + pOH = 14

pOH = 3,34 ∴

$[OH] = 4,6 \times 10^{-4}$

p/ 250 ml — x mol

1000 ml — $4,57 \times 10^{-4}$

$\boxed{x = 1,14 \times 10^{-4}\ mol}$

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⑭

pH	H^+	OH^-	caráter
1	0,1	1×10^{-13}	ácido
10,50	$3,16 \times 10^{-11}$	$3,16 \times 10^{-4}$	básico
2,88	$1,30 \times 10^{-3}$	$7,76 \times 10^{-12}$	ácido
10,36	$4,36 \times 10^{-11}$	$2,30 \times 10^{-4}$	básico

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⑮ a. $XOH \rightarrow X^+ + OH^-$

I. 0,0150   0   0

E. 0,0142 8×10^{-4} 8×10^{-4}

dado: pH = 10,90 ∴ pOH = 3,10

$[OH^-] = 8 \times 10^{-4}\ mol/L$

b. $K_b = \frac{(8 \times 10^{-4})^2}{0,0142}$

$\boxed{K_b = 4,51 \times 10^{-6}}$

↳ base forte, moderadamente fraca

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⑯ $NH_2OH \xrightarrow{H_2O} OH^- + NH_2OH_2^+$

0,250   0   0

$1,29 \times 10^{-5}$ $1,29 \times 10^{-5}$

dado: pH = 9,11 → pOH = 4,89

$[OH^-] = 1,29 \times 10^{-5}\ mol/L$

$K_b = \frac{(1,29 \times 10^{-5})^2}{0,249} = \boxed{6,68 \times 10^{-10}}$

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⑰ O ácido 4 clorobenzoico, pois quanto maior Ka mais forte será o ácido